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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/665,298

09/17/2003

Michael C. Green

005513P018

5448

45288

7590

10/01/2009

VARIAN/BSTZ

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP

1279 OAKMEAD PARKWAY

SUNNYVALE, CA 94085-4040

EXAMINER

KALAM, ABUL

ART UNIT

PAPER NUMBER

2814

MAIL DATE

DELIVERY MODE

10/01/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/665,298	Applicant(s) GREEN ET AL.	
	Examiner Abul Kalam	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 and 49-51 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-29 and 49-51 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 17, 2009, has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-29 and 49-51 are rejected under 35 U.S.C. 103(a) as being anticipated by Harel et al. (WO 02/067014, which is a publication of PCT/IL02/00124; for examination purposes, the US Publication 2005/0118527 will be referred to in the rejection).

Regarding claims 1, 3 and 4, Harel discloses a photodetector (Fig. 14) comprising:

a first semiconductor layer (4, Fig. 14) comprising a first semiconductor material (¶ [0186]: lead iodide); and

a second semiconductor layer (5, Fig. 14) comprising a second semiconductor material (¶ [0186]: mercuric iodide) coupled to the first semiconductor material, the first and second semiconductor layers forming a heterojunction (¶ [0187]: “hybrid bi-layer”), the first and second semiconductor materials being halides (¶ [0188]: PbI_2 and HgI_2).

Although Harel does not disclose in this embodiment that the first and second semiconductor layer are consisting of a first and second semiconductor material, respectively, however, Harel shows in Fig. 13 that PVD deposited lead iodide and PVD deposited mercuric iodide have greater sensitivity than PIB lead iodide composite and PIB mercuric iodide composite, respectively. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention, to form the first and second semiconductor layer consisting of semiconductor materials, such as PVD deposited lead iodide and PVD deposited mercuric iodide, respectively, in order to provide a photo-detector with greater sensitivity. Furthermore, Harel discloses that lead iodide and mercuric iodide were well known, and conventionally used in photo-detectors (¶ [0002]-[0019]), at the time of invention.

Regarding claim 2, since Harel teaches the same materials as claimed by Applicant, it is implicit that Harel's semiconductor materials also have approximately the same bandgap. It has been held that claimed properties are presumed to be inherent

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when the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes (**MPEP 2112.01**).

Regarding claims 5 and 6, Harel discloses the photodetector further comprising: a first contact (bottom pixel electrode, ¶ [0187]); and a second contact (6, Fig. 14), wherein the plurality of semiconductor materials are disposed between the first and second contacts (Fig. 14), wherein at least one of the first and second contacts comprises palladium (¶ [0141]).

Regarding claim 7, Harel discloses wherein the second semiconductor material comprises mercuric iodide (HgI_2 , Fig. 13) and the first semiconductor material (PbI_2 , Fig. 13) is less chemically reactive than mercuric iodide with the contacts. It has been held that claimed properties are presumed to be inherent when the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes (**MPEP 2112.01**).

Regarding claims 8-12, Harel does not disclose the thicknesses of the first and second semiconductor material. However, it has been held that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955). Furthermore, where patentability is said to be based upon particular chosen range or dimension recited in a claim, the Applicant must show that the chosen range or dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the first, and second semiconductor materials with a thickness in the claimed ranges, for the purpose of optimization through routine experimentation. Furthermore, note that the claimed ranges are not critical nor do they yield unpredictable results.

Regarding claims 13-15, Harel discloses a photodetector (Fig. 14) comprising:
a plurality of semiconductor materials (§ [0186]-[0190]) comprising:
a first semiconductor layer (4, Fig. 14) comprising a first semiconductor material (§ [0186]: lead iodide); and
a second semiconductor layer (5, Fig. 14) comprising a second semiconductor material (§ [0186]: mercuric iodide) coupled to the first semiconductor material, the first and second semiconductor layers forming a first heterojunction (§ [0187]: “hybrid bi-layer”), the first and second semiconductor materials being halides (§ [0188]: HgI_2 and PbI_2);
wherein the first and second semiconductor material comprises lead iodide and mercuric iodide, respectively (§ [0188]: PbI_2 and HgI_2);
wherein the plurality of semiconductor materials further comprises a third semiconductor layer comprising a third semiconductor material comprising lead iodide (§ [0190]: “lead iodide PIB layer”) coupled to the second semiconductor material (§ [0190]: “mercuric iodide PIB layer”), the second and third semiconductor layers forming a second heterojunction (§ [0190]: “tri-layer”).

Although Harel does not disclose in this embodiment that the first, second and third semiconductor layer are consisting of a first, second and third semiconductor material, respectively, however, Harel shows in Fig. 13 that PVD deposited mercuric iodide and PVD deposited lead iodide have greater sensitivity than PIB mercuric iodide composite and PIB lead iodide composite, respectively. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention, to form the first, second and third semiconductor layer consisting of semiconductor materials, such as PVD deposited lead iodide and PVD deposited mercuric iodide, respectively, in order to provide a photo-detector with greater sensitivity. Furthermore, Harel discloses that semiconductor materials such as lead iodide and mercuric iodide were well known, and conventionally used in photo-detectors (§ [0002]-[0019]), at the time of invention.

Regarding the claimed band gap of the first, second and third semiconductor material, note that the band gap is a property of the material and Harel teaches the same materials as claimed by Applicant. It has been held that claimed properties are presumed to be inherent when the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes (**MPEP 2112.01**).

Regarding the claimed thicknesses of the first, second and third semiconductor material, it has been held that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955). Furthermore, where patentability is said to be based upon particular chosen range or

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dimension recited in a claim, the Applicant must show that the chosen range or dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the first, second and third semiconductor materials with thicknesses as claimed, for the purpose of optimization through routine experimentation. Furthermore, note that the claimed ranges are not critical nor do they yield unpredictable results.

Regarding claims 16-18, Harel discloses wherein the first semiconductor material comprises lead iodide and the second semiconductor material comprises mercuric iodide and each of the first and second semiconductor materials consists of a semiconductor material (Fig. 13: PVD-PbI₂ and PVD-HgI₂). Furthermore, regarding the limitations of having different "conductivity types," and band gaps within "10 percent of each other," note that Harel discloses similar materials, and thus, the claimed properties are implicit. It has been held that claimed properties are presumed to be inherent when the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes (**MPEP 2112.01**).

Regarding claim 19, Harel discloses a photodetector (Fig. 14) comprising:
a first semiconductor layer (5, Fig. 14) comprising a first semiconductor material (¶ [0186]: mercuric iodide); and

a second semiconductor layer (4, Fig. 14) comprising a second semiconductor material (¶ [0186]: lead iodide) coupled to the first semiconductor material, the first and second semiconductor layers forming a heterojunction (¶ [0187]: “hybrid bi-layer”), the first and second semiconductor materials being halides (¶ [0188]: PbI_2 and HgI_2);

wherein the first semiconductor material comprises mercuric iodide and the second material comprises lead iodide (¶ [0188]).

Although Harel does not disclose in this embodiment that the first and second semiconductor layer are consisting of a first and second semiconductor material, respectively, however, Harel shows in Fig. 13 that PVD deposited lead iodide and PVD deposited mercuric iodide have greater sensitivity than PIB lead iodide composite and PIB mercuric iodide composite, respectively. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention, to form the first and second semiconductor layer consisting of semiconductor materials, such as PVD deposited mercuric iodide and PVD deposited lead iodide, respectively, in order to provide a photo-detector with greater sensitivity. Furthermore, Harel discloses that lead iodide and mercuric iodide were well known, and conventionally used in photo-detectors (¶ [0002]-[0019]), at the time of invention.

Regarding the claimed conductivity type and band gap of the semiconductor materials, note that the limitations are drawn to the properties of the materials, and Harel teaches the claimed materials. It has been held that claimed properties are presumed to be inherent when the claimed and prior art products are identical or

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substantially identical in structure or composition, or are produced by identical or substantially identical processes (**MPEP 2112.01**).

Regarding the relative thickness of the second semiconductor layer to the first semiconductor layer, note that where patentability is said to be based upon a particular chosen range or dimension recited in a claim, the Applicant must show that the chosen range or dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the second semiconductor material thicker than the first semiconductor material, because changes in dimension are generally recognized as being within the level of ordinary skill in the art.

Regarding claim 20, Harel discloses wherein the plurality of semiconductor materials further comprises a third semiconductor material comprising lead iodide coupled to the second semiconductor material (¶ [0190]).

Regarding claims 21-23, Harel discloses wherein the first semiconductor material comprises bismuth iodide and the second semiconductor material comprises one of mercuric iodide and lead iodide (¶ [0186]).

Regarding claims 24-26, Harel discloses wherein the first semiconductor material comprises thallium bromide and the second semiconductor material comprising one of mercuric iodide and lead iodide (¶ [0186]).

Regarding claims 27-29, note that the limitations of “negative bias,” “ground” and “negative voltage,” are drawn to intended use. It has been held that a recitation with

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respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex parte Masham, 2 USPQ F.2d 1647 (1987).

Regarding claims 49 and 50, Harel discloses a photodetector (Fig. 14) comprising:

a first semiconductor layer (4, Fig. 14) comprising a first semiconductor material (¶ [0186]: lead iodide); and

a second semiconductor layer (5, Fig. 14) comprising a second semiconductor material (¶ [0186]: mercuric iodide) coupled to the first semiconductor material, the first and second semiconductor layers forming a heterojunction (¶ [0187]: “hybrid bi-layer”), the first and second semiconductor materials being halides (¶ [0188]: PbI_2 and HgI_2);

wherein the first semiconductor material comprises lead iodide and the second material comprises mercuric iodide (¶ [0188]).

Although Harel does not disclose in this embodiment that the first and second semiconductor layer are consisting of a first and second semiconductor material, respectively, however, Harel shows in Fig. 13 that PVD deposited lead iodide and PVD deposited mercuric iodide have greater sensitivity than PIB lead iodide composite and PIB mercuric iodide composite, respectively. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention, to form the first and second semiconductor layer consisting of semiconductor materials, such as PVD deposited lead iodide and PVD deposited mercuric iodide, respectively, in order to provide a photo-detector with greater sensitivity. Furthermore, Harel discloses that lead iodide

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and mercuric iodide were well known, and conventionally used in photo-detectors (¶ [0002]-[0019]), at the time of invention.

Regarding the claimed conductivity type of the semiconductor materials, note that the limitations are drawn to the properties of the materials, and Harel teaches the claimed materials. It has been held that claimed properties are presumed to be inherent when the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes (**MPEP 2112.01**).

Regarding claim 51, Harel discloses wherein the first semiconductor layer is a single first semiconductor material (PbI_2) and the second semiconductor layer is a single second semiconductor material (HgI_2) (Fig. 13).

Response to Arguments

3. Applicant's arguments with respect to claims 1-29 and 49-51 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abul Kalam whose telephone number is (571)272-8346. The examiner can normally be reached on Monday - Friday, 9 AM - 5 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. K./
Examiner, Art Unit 2814

/Wael M Fahmy/
Supervisory Patent Examiner, Art
Unit 2814